BY ORDER OF
THE SECRETARY OF THE AIR FORCE

AIR FORCE INSTRUCTION 21-124

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Guidance and Procedures

AIR FORCE OIL ANALYSIS PROGRAM

COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

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This instruction implements AFPD 21-1, Managing Aerospace Equipment Maintenance. It provides guidance and assigns responsibility for managing the Air Force Oil Analysis Program (AF OAP) and for participating in the Joint Oil Analysis Program (JOAP). Technical Orders (TO) 33-1-37-1/-2/-3/-4 outline the technical aspects of oil analysis. Major Commands (MAJCOM) must coordinate any supplementing Command instructions with HQ USAF/LGM prior to publication. HQ USAF/LGM must approve any deviations from this instruction. This instruction applies to all Air Force and DoD contractor activities, including the Air National Guard and the Air Force Reserve.

SUMMARY OF REVISIONS

This instruction replaces AFR 66-39, Oil Analysis Program. Requires a centrally-managed oil analysis program.

1. Program Objective. The objective of the AF OAP is to detect incipient oil wetted equipment failures before serious malfunction or secondary damage occurs. This is primarily achieved by monitoring the physical properties of used lubricants and the concentration of wear metals in fluids used to lubricate or power mechanical systems.

This helps aircraft technicians and supervisors to make informed, condition-based, preventive maintenance decisions, and can reduce equipment costs, increase equipment availability, and reduce inflight risk. Responsible activities must ensure the resultant data is accurate and given promptly to all customers so they can effectively monitor the condition of their equipment. The integration of AF OAP and JOAP plans are essential to attain the program objective.

2. Program Guidance. To monitor lubricant/fluid conditions, the AF OAP uses atomic emission/absorption (AE/AA) spectrometric wear metal analysis, magnetic chip detectors and, to a very limited

extent, physical property testing (viscosity, water/fuel contamination, additive levels, etc.). Non-Depot AF OAP laboratories must provide oil analysis services at no charge to all US Government transient aircraft/equipment. Take oil samples from transient aircraft IAW applicable technical data and owning activity requirements. For transient aircraft with an Engine Monitoring System (EMS), at bases without the capability to download Engine Operating Time (EOT) data, Engine Flying Hours (EFH) should be used to continue oil analysis trending. To the extent deemed cost effective, EOT should be used as the standard time interval between oil analysis sampling when in-service engines are equipped with an EMS or other operating time recorders. For engines without EMS or other operating time recorders, oil analysis trending intervals will be standardized based upon EFH. AF OAP laboratories will periodically evaluate response times to optimize support of the customer. Each AF OAP laboratory must be certified annually under guidelines established by the AF OAP Management Office (SA-ALC/LDE) and the JOAP Technical Support Center (JOAP-TSC). Regional laboratories, servicing specific geographical areas, are the preferred mode of operation. Establish base laboratories only when equipment-directed response times or operational requirements rule out the use of a regional laboratory. Seek to maximize interservice use of existing laboratories through laboratory consolidation, workload sharing, and use of standardized instrumentation, techniques and procedures.

3. HQ USAF Responsibilities. The Directorate of Maintenance (AF/LGM) provides overall guidance for the AF OAP and coordinates Air Force participation in the JOAP; coordinates AF OAP requirements within the Air Staff; in conjunction with AFMC guides and directs the Air Force member of the JOAP-CG in developing Air Force positions on all JOAP matters; ensures changes to maintenance policies affecting oil analysis are coordinated with the AF OAP Management Office; and seeks to optimize OAP laboratory utilization through the consolidation and regionalization of Air Force and/or other service laboratories.

4. Air Force Materiel Command (AFMC) Responsibilities. AFMC is the lead MAJCOM for the AF OAP and Air Force participation in the JOAP. HQ AFMC/EN is the headquarters office of primary responsibility and ensures coordination of AF OAP policy and guidance with HQ USAF/LGM, other MAJCOMs, and other services.

4.1. Directorate of Aerospace Equipment Maintenance (SA-ALC/LD). The Directorate of Aerospace Equipment Maintenance represents the Air Force on the JOAP Executive Committee (JOAP-EC); establishes, funds, staffs, and directs and AF OAP Management Office (SA-ALC/LDE); procures oil analysis equipment at the request of the AF OAP Management Office or the JOAP-TSC; provides technical order provisioning and support, and establishes interservice logistics support (spare parts support, instrument repair and overhaul, procurement of common JOAP laboratory equipment and supplies, item management and equipment specialist activities, and funding status of existing contracts).

4.2. Propulsion Product Group Manager (PPGM). SA-ALC/LR as the PPGM ensures Center OAP Managers are identified for each Air Force ALC with engine management responsibilities, and the Aeronautical Systems Center (ASC); ensures engine OAP Managers are identified for each Air Force-managed engine; works with the AF OAP Management Office to assess existing/potential oil analysis technologies and takes an active role in ensuring wear metal debris and oil analysis are an integral part of engine trending and diagnostics analysis.

4.3. Center Propulsion Directorates. The Center Propulsion Directorates (SA-ALC/LP, OC-ALC/LP, and ASC/LP) assign Center OAP Managers, with duties as outlined in paragraph **4.4.** As the

development program manager, ASC ensures that, where appropriate, oil analysis sampling provisions are included during the design phase.

4.4. Center OAP Managers. As the Center focal point for AF OAP issues, Center OAP Managers keep Engine OAP Managers, equipment specialists, and program managers aware of AF OAP objectives, policies and procedures. In concert with Engine OAP Managers, Center OAP Managers will establish a metric on hits, misses and escapes, and send a copy of this information quarterly to the PPGM, the MAJCOMs and the AF OAP Management Office. Center OAP Managers ensure that their Center has a process in place to give special handling to equipment returned for tear down or overhaul because of an OAP laboratory maintenance recommendation or where oil analysis results indicate a potential problem.

4.5. Engine OAP Managers. Engine OAP Managers provide the guidance necessary to accomplish engine-specific oil analysis; ensure expeditious handling of equipment returned for tear down or overhaul because of an OAP laboratory maintenance recommendation or where oil analysis results indicated a potential problem; provide updates for TOs 33-1-37-1/-2/-3/-4 (the JOAP Manual) to the OAP Management Office; provide accurate and timely feedback to field units on OAP-monitored equipment, to include maintenance findings on equipment in for tear down or overhaul as a result of an OAP laboratory maintenance recommendation, and failure reports and related wear metal and oil analysis data on oil-wetted components where no OAP laboratory maintenance recommendation was made; establish and maintain wear metal limits, diagnostic criteria, and other oil analysis parameters based on an annual review of data from equipment tear down and overhaul findings; provide the Center OAP Manager a metric on hits, misses and escapes; work with MAJCOM customers and the AF OAP Management Office to establish engine-specific technical and performance requirements for all wear metal debris and oil analysis equipment; evaluate cost effectiveness of existing and potential wear metal debris and oil analysis applications, establish test programs where needed, and implement the most cost effective method(s); establish and update specific oil sampling intervals and wear metal limits (evaluate for new engines during the design phase; reconsider for existing engines when oil-wetted parts undergo any material or strength changes).

4.6. AF OAP Management Office. The AF OAP Management Office manages the AF OAP, and in coordination with the MAJCOMs and propulsion community, leads AF participation in the JOAP; represents the Air Force on the JOAP-CG; coordinates and consolidates MAJCOM and Air Force requirements with Army and Navy requirements to ensure, where practical, the procurement of common OAP equipment; assists the JOAP-TSC to develop a comprehensive OAP laboratory certification and quality control program; staffs and funds the JOAP-TSC based on its charter and the tri-service memorandum of agreement; assists MAJCOM managers to achieve a highly effective program; recommends for MAJCOM approval the establishment, location, and relocation of AF OAP laboratories; establishes and manages a data system, meeting tri-service requirements, to evaluate AF OAP participation and effectiveness and to provide engine program offices with historical data on oil sample analysis results; certifies/decertifies AF OAP laboratories to participate in the JOAP; maintains and provides Air Force inputs to TO 33-1-37-1/-2/-3/-4, JOAP Manual; maintains a list of AF OAP laboratories, equipment and customers; reviews and evaluates the JOAP school curriculum; and evaluates the need for and performs special studies requested by the MAJCOMs or depots.

4.7. Wright Laboratory. The Wright Laboratory funds and accomplishes Research, Development, Test, and Evaluation (RDT&E) efforts to improve wear metal and oil analysis instruments, materials,

and techniques; has responsibility for all Air Force OAP field T&E; coordinates RDT&E activities with the PPGM, the AF OAP Management Office, the JOAP-TSC, and the MAJCOMs.

5. Air Education and Training Command (AETC) Responsibilities. AETC provides initial oil analysis training and, at the request of the AF OAP Management Office and the MAJCOMs, follow-on training. AETC coordinates course material changes with the AF OAP Management Office, the JOAP-TSC and the MAJCOM OPRs.

6. MAJCOM Responsibilities. Each MAJCOM establishes a headquarters OPR for complying with MAJCOM OAP responsibilities; approves the establishment of OAP laboratories to support assigned systems and customers within specific geographical areas designated by the AF OAP Management Office; ensures owning units submit accurate and timely quality deficiency reports to the applicable engine program offices on all equipment requiring tear down or overhaul due to an OAP laboratory maintenance recommendation and on all oil-wetted component failures where no OAP laboratory maintenance recommendation was made; ensures each laboratory provides the depot a copy of DD Form 2027, Oil Analysis Record, for each engine undergoing scheduled maintenance or overhaul; ensures that each OAP laboratory inputs timely and accurate oil analysis data to the central data base; ensures the proper training of OAP laboratory technicians; ensures each laboratory accomplishes interservice oil analysis within 24 hours of sample receipt, giving precedence to aviation engine and transient alert aircraft samples; ensures that assigned shop instrumentation and equip ment is not modified or used for non-OAP applications without AF OAP Management Office concurrence; provides guidance necessary to execute the AF OAP and ensures that all subordinate organizations understand and properly execute their AF OAP and JOAP responsibilities; and ensures that all applicable programming documents (budget, facilities, manpower, maintenance, etc.) include the need for AF OAP and JOAP support.

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DCS/Logistics

Attachment 1

GLOSSARY OF TERMS

Certification Program —A program to assure OAP laboratories are qualified to analyze fluid samples, evaluate the results, and make proper maintenance recommendations.

Common Instrumentation —Instruments used by two or more of the services to analyze used fluids.

Common Operating Equipment —Equipment that has common functions, oil-wetted parts of like design, and similar failure modes.

Correlation Program —A program for OAP laboratories to analyze standard oil samples to ensure their spectrometric oil procedures and equipment produce acceptable results.

Customer —Any activity, agency or organization authorized to receive OAP laboratory support services.

Escape —An in-service failure or abnormal wear finding where no OAP laboratory maintenance recommendation was made.

Evaluation Criteria —A set of guidelines for evaluating sample results to determine equipment operating conditions, e.g., wear metal concentration trends, wear metal diagnostic criteria, decision tables, and component isolation guidelines.

Hit —An OAP laboratory maintenance recommendation confirmed by a physical finding of abnormal wear or potential for catastrophic failure.

JOAP Coordinating Group (JOAP-CG) —A tri-service group of Army, Navy, and Air Force OAP managers responsible for implementing and monitoring JOAP standard activities.

JOAP Technical Support Center (JOAP-TSC) —A tri-service organization staffed with technical representatives from each service tasked with supporting the JOAP-CG.

Miss —An OAP laboratory maintenance recommendation followed by a physical finding of no abnormal wear or potential for catastrophic failure.

Oil Analysis —The process of analyzing oil and other fluids used to lubricate or operate mechanical equipment, evaluating the condition of the fluid or the equipment from which the fluid originated, and recommending maintenance actions to the equipment operating activity.

Oil Analysis Program Laboratory (OAP Laboratory) —An Air Force, Army, Navy, contractor, foreign government or other activity certified by the JOAP-TSC to analyze used oils or other fluids found in DoD-owned-and-operated equipment.

Response Time —The interval from when a fluid sample is drawn from the equipment to when the OAP laboratory provides the results of its analysis to the customer.

Spectrometer —An instrument which uses the atomic emission or atomic absorption principle to identify the types and concentrations of wear metals in used fluid samples.

Spectrometric Calibration Standard —An oil containing precisely-controlled quantities of specific organometallic compounds, with controlled viscosity and flash point, for calibrating and standardizing spectrometers.

Spectrometric Oil Analysis —Process of determining the type and concentration of wear metals in fluids by use of a spectrometer.